09-22-00 A

JC821 U.S. PTO 09/21/00

# UTILITY PATENT APPLICATION TRANSMITTAL

(only for new nonprovisional applications under 37 CFR § 1.53(b))

| | |
|---|---|
| Attorney Docket No. | 10188 |
| Inventor(s) or Application Number | Jay K. Keung, Karen B. Perez, Robert A. Migliorini |
| Title | Heat-Sealable Multilayer White Opaque Film |
| Express Mail Label No. | EL227705097US |

JC714 U.S. PTO 09/666928 09/21/00

## APPLICATION ELEMENTS

ADDRESS TO: **Assistant Commissioner for Patents, Box Patent Application, Washington, D.C. 20231**

1. ☒ Fee Transmittal Form (e.g., PTO/SB/17) (Submit an original, and a duplicate for fee processing)

2. ☒ Specification Total Pages 17 (preferred arrangement set forth below)
   - Descriptive title of the Invention
   - Cross References to Related Applications (if any)
   - Background of the Invention
   - Brief Summary of the Invention
   - Brief Description of the Drawings (if filed)
   - Detailed Description
   - Claim(s)
   - Abstract of the Disclosure

3. ☐ Drawing(s) (35 U.S.C. 113) Total Sheets

4. Oath or Declaration Total Pages 4
   a. ☒ Newly executed (original or copy)
   b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d)) (for continuation/division with Box 15 completed) [Note Box 5]
      i. ☐ DELETION OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. §§ 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference (useable if Box 4B is checked) The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered to be part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Microfiche Computer Program (Appendix)

### ACCOMPANYING APPLICATION PARTS

7. ☒ Assignment Papers (cover sheet & document(s))

8. ☐ 37 C.F.R. § 3.73(b) Statement (when there is an assignee) ☐ Power of Attorney

9. ☐ English Translation Document (if applicable)

10. ☒ Information Disclosure Statement (IDS)/PTO-1449
    ☒ Copies of IDS Citations

11. ☐ Preliminary Amendment

12. ☒ Return Receipt Postcard (MPEP 503) (Should be specifically itemized)

13. ☐ Certified Copy of Priority Document(s) (if foreign priority is claimed)

14. ☐ Other:

15. If a CONTINUING APPLICATION, check appropriate box, and supply the requisite information below and in a preliminary amendment.

☐ Continuation ☐ Divisional ☐ Continuation-in-part (CIP)

of prior application No: _____, from which priority is claimed under 35 U.S.C. § 120

Prior application information: Examiner _____ Group Art Unit _____

16. If a NONPROVISIONAL APPLICATION based upon a foreign or U.S. provisional application, priority is claimed from application No. 60/159,205, country US, filed on October 13, 1999.

## 17. CORRESPONDENCE ADDRESS

☐ Customer Number or Bar Code Label or ☒ Correspondence address below

(Insert Customer No. or Attach bar code label here)

| | | | | | |
|---|---|---|---|---|---|
| Name | ExxonMobil Chemical Company | | | | |
| Address | P.O. Box 2149 | | | | |
| City | Baytown | State | Texas | Zip Code | 77522 |
| Country | U.S.A. | Telephone | 281-834-2581 | Fax | 281-834-2911 |
| Name (print/type) | T. Dean Simmons | Registration No. (Attorney/Agent) | 30,976 | | |
| Signature | | Date | September 21, 2000 | | |

# FEE TRANSMITTAL

Patent fees are subject to annual revision on October 1.
These are the fees effective November 10, 1998

| Complete if Known | |
|---|---|
| Application Number | Not Yet Assigned |
| Filing Date | Herewith |
| First Named Inventor | Keung, et al. |
| Group Art Unit | Not Assigned |
| Examiner Name | Not Assigned |
| Attorney Docket Number | 10188 |

Total Amount of Payment ($)690.00

## METHOD OF PAYMENT

☒ The Commissioner is hereby authorized to charge indicated fees and credit any over payment to:

Deposit Account Number: **05-1712**

Deposit Account Name: **Mobil Oil Corporation**

☒ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

☐ Charge the Issue Fee Set in 37 CFR 1.18 at the Mailing of the Notice of Allowance

## FEE CALCULATION

### 1. FILING FEE

| Large Entity Fee Code | Fee $ | Fee Description | Fee Paid |
|---|---|---|---|
| 101 | 690 | Utility filing fee | 690.00 |
| 106 | 310 | Design filing fee | |
| 107 | 480 | Plant filing fee | |
| 108 | 760 | Reissue filing fee | |
| 114 | 150 | Provisional filing fee | |
| | | **SUBTOTAL (1)** | ($) 690.00 |

### 2. CLAIMS

| | Extra | Fee from below | Fee Paid |
|---|---|---|---|
| Total Claims | 10 - 20 = 0 x | 18 = | 0.00 |
| Independent Claims | 2 - 3 = 0 x | 78 = | 0.00 |
| Multiple Dependent Claim | | 260 = | |

| Large Entity Fee Code | Fee $ | Fee Description |
|---|---|---|
| 103 | 18 | Claims in excess of 20 |
| 102 | 78 | Independent claims in excess of 3 |
| 104 | 260 | Multiple dependent claim |
| 109 | 78 | Reissue independent claims over original patent |
| 110 | 18 | Reissue claims in excess of 20 and over original patent |
| | | **SUBTOTAL (2)** ($) 0.00 |

## FEE CALCULATION (continued)

### 3. ADDITIONAL FEES

| Fee Code | Large Entity Fee | Fee Description | FEES PAID |
|---|---|---|---|
| 105 | 130 | Surcharge - late filing fee or oath or declaration | |
| 127 | 50 | Surcharge - late provisional filing or cover sheet | |
| 139 | 130 | Non-English specification | |
| 147 | 2520 | For filing a request for reexamination | |
| 112 | 920* | Req. publication of SIR prior to Examiner action | |
| 113 | 1840* | Req. publication of SIR after Examiner action | |
| 115 | 110 | Extension for reply within first month | |
| 116 | 380 | Extension for reply within second month | |
| 117 | 870 | Extension for reply within third month | |
| 118 | 1360 | Extension for reply within fourth month | |
| 128 | 1850 | Extension for reply within fifth month | |
| 119 | 300 | Notice of appeal | |
| 120 | 300 | Filing a brief in support of an appeal | |
| 121 | 260 | Request for oral hearing | |
| 138 | 1510 | Petition to institute a public use proceeding | |
| 140 | 110 | Petition to revive - unavoidable | |
| 141 | 1210 | Petition to revive - unintentional | |
| 142 | 1210 | Utility issue fee (or reissue) | |
| 143 | 430 | Design issue fee | |
| 144 | 580 | Plant issue fee | |
| 122 | 130 | Petition to the Commissioner | |
| 123 | 50 | Petitions related to provisional applications | |
| 126 | 240 | Submission of Information Disclosure Stmt. | |
| 581 | 40 | Recording each patent assignment per property (times number of properties) | 40.00 |
| 146 | 760 | Filing a submission after final rejection (37 CFR 1.129(a)) | |
| 149 | 760 | For each additional invention to be examined (37 CFR 1.129(b)) | |
| Other Fee (specify) | | | |
| Other Fee (specify) | | | |
| *Reduced by basic filing fee paid | | **SUBTOTAL (3)** | ($)40.00 |

| SUBMITTED BY | | | | Complete (if applicable) | |
|---|---|---|---|---|---|
| Typed or Printed Name | T. Dean Simmons | | | Reg. Number | 30,976 |
| Signature | | Date | September 21, 2000 | Deposit Account User ID | |

# HEAT-SEALABLE MULTILAYER WHITE OPAQUE FILM

The present application claims the benefit of U.S. provisional application Serial No. 06/159,205 filed October 13, 1999.

## BACKGROUND OF THE INVENTION

The present invention relates to multilayer plastic films and, more particularly, to heat sealable multilayer white opaque films suitable for packaging of heat-sensitive items.

Plastic films are currently used in many food packaging operations. To be commercially viable, these plastic films must be economically priced, be compatible with modern high speed packaging machinery and methods, and be suitable for the particular packaging application.

It will be appreciated by those skilled in the art that certain packaging applications, e.g., packaging of heat-sensitive items such as frozen novelties, including ice cream bars and ice cream sandwiches, introduce certain specific design criteria into the packaging operation. These specific design criteria include sealability at low temperature and with minimum applied pressure, a distinctive pleasing appearance with at least one printable surface, and compatibility with high speed packaging, machinery and methods. To date, the prior art has been unable to provide a film exhibiting the aforementioned design criteria suitable for packaging heat-sensitive items such as frozen novelties, including ice cream bars and ice cream sandwiches.

There is therefore a need in the art for a heat sealable multilayer white opaque film which is sealable at low temperature and with a minimum of applied pressure, provides a distinctive pleasing appearance with at least one printable surface, and is compatible with high speed packaging machinery and methods.

## SUMMARY OF THE INVENTION

The present invention, which addresses the needs of the prior art, relates to a heat-sealable multilayer white opaque plastic film which includes a cavitated polypropylene core layer having a first and a second surface. A top tie layer formed of polypropylene and incorporating a whitening agent is positioned adjacent to the first surface of the core layer. A top skin layer of polypropylene, or a polyolefin terpolymer, containing an antiblock agent, overlays the top tie layer. The film also has a polypropylene bottom tie layer positioned adjacent to the second surface of the core layer. A bottom skin layer of a polyolefin terpolymer and one or more antiblock agents or antiblock slip agents is positioned adjacent to the bottom tie layer.

In a first embodiment, the present invention provides a plastic film that is heat sealable on one side. The top (non-sealable) skin layer of the film is formed from polypropylene. The cavitating agent incorporated into the polypropylene core layer is a polybutylene terephthalate polymer. The top and bottom tie layers are formed from polypropylene and the polyolefin polymer of the bottom skin layer is a heat sealable ethylene-propylene-butylene terpolymer. Silicone oil is used as an antiblock agent and the antiblock slip agent is a crosslinked silicone.

In a second embodiment, the present invention provides a plastic film that is heat sealable on both sides. The top skin layer is an ethylene-propylene-butylene terpolymer containing $SiO_2$ and an antiblock agent. The core layer contains a polybutylene terephthalate cavitating agent, a phosphite antioxidant, and a fluoropolymer as the anti-condensing agent. The polyolefin polymer of the bottom skin layer is an ethylene-propylene-butylene terpolymer, with silicone oil as the antiblock agent, and a crosslinked silicone as the antiblock slip agent.

The present invention also relates to a method of packaging a frozen novelty. The method includes the step of providing a frozen ice cream preparation. The method further includes the additional step of enclosing the ice cream preparation in a heat sealable white opaque multilayer plastic film. Finally,

the method includes the step of sealing the film to enclose the frozen ice cream preparation.

Thus, the present invention provides a packaging film which is sealable at a low temperature, and which is suitable for use with heat-sensitive items such as frozen novelties, including ice cream bars and ice cream sandwiches. Furthermore, the new films are compatible with modern high speed packaging machinery and methods, and are receptive to printing and labeling for marketing appeal.

These enhanced properties are achieved because the film of the present invention provides certain desirable characteristics including reduced plate out (wear of machine surfaces due to scouring and abrasion by exposed film components, especially hard additives such as titanium dioxide, $TiO_2$), and a consistent low coefficient of friction (COF), good hot slip properties and improved hot tack and z-tear resistance for packaging. As a result, the film seals with a minimum of applied heat or pressure and still has a pleasing appearance, with at least one printable surface.

## DETAILED DESCRIPTION OF THE INVENTION

The present invention provides a multilayer white opaque plastic film heat-sealable on one or two sides, with improved hot tack and z-tear resistance characteristics; reduced plate out; a lower and consistent and coefficient of friction (COF); good hot slip properties; and with a sealant layer that has a distinctive pleasing appearance. At least one exposed surface of the film is suitable for receiving an image which may be printed or affixed.

The plastic film of the present invention includes at least five layers. The core layer is the central layer of the five layer film structure. On each surface of the core layer is a tie layer. An outer skin layer is present on each side of the multilayer structure.

Each layer itself is formed from one or more polyolefin polymer compositions. Suitable polyolefin polymers include for example, polypropylene (PP), ethylene-propylene copolymers (EP), and ethylene-propylene-butylene

terpolymers (EPB). It will be appreciated that skin layers formed from EP copolymers or EPB terpolymers typically exhibit heat-sealing properties. Thus, a multilayer film having one skin layer formed from heat sealable polymers is heat-sealable on one side, whereas a multilayer film having both skin layers of a heat sealable polymer is heat-sealable on two sides.

The multilayer polyolefin films of the present invention are opaque, white films. The opacity and whiteness characteristics are due to the presence of whitening agents, particles and cavitation in one or more layers of the film.

Preferably, the core layer of the multilayer film is rendered opaque as a result of cavitations within the layer. This cavitation is accomplished by adding an amount of a cavitating agent to the core layer prior to stretching of the film. When the multilayer film is subsequently stretched, the cavitating agent produces voids in the core layer which engender a characteristic opacity to the film. The cavitating agent may be any substance which is harder than the polyolefin of the layer to which it is added. Suitable cavitating agents include any polymer which is harder than the matrix polymer, such as, for example polybutylene terephthalate (PBT) in a polypropylene (PP) matrix.

The whitening agent or agents, which are incorporated into at least one layer of the film, also contribute to the whiteness and opacity of the films of the present invention. At least one of the tie layers of the film comprises a whitening agent. Alternatively, the whitening agent may be present in two tie layers. Suitable whitening agents include but are not limited to white pigments, such as for example $TiO_2$, $CaCO_3$, $BaSO_4$, ZnS, $MgCO_3$, clay, talc, kaolin, or any other highly reflective white compound. In a preferred embodiment, the whitening agent is $TiO_2$. In an even more preferred embodiment, the whitening agent is the $TiO_2$ product, Millenium RCL4®

Other additives and agents may be suitable for incorporation into one or more layers of the films of the present invention. Additives may be selected from any class of additives, including for example, antioxidants, anti-condensing agents, slip agents, pigments, fillers, foaming agents, flame retardants, photodegradable agents, UV sensitizers or UV blocking agents, crosslinking

agents, silicon compounds (e.g. $SiO_2$) and anti-block agents to name but a few of the many known additives.

Anti-oxidants suitable for incorporation in the films of the present invention may be from any class of anti-oxidant, such as a phosphite, for example Ultranox® 626. The anti-condensing agent may be any anti-condensing agent, for example a fluoropolymer, such as for instance Dyneon® flurololymer FX9613. The antiblock agents suitable for use with the films of the present invention may be any antiblock agent, including those which function as antiblock, slip agents, for example a methyl acrylate such as Epostar® MA 1002 (Nippon Shokubai, Osaka, Japan).

The silicon compounds include various forms of $SiO_2$, which may be for example, in the form of coated or uncoated silica including for example, Sylobloc® 44 and Sylobloc® 45, respectively, supplied by W.R. Grace; alternatively, the silicon compound may be, for example a silicone oil. The silicone oil may be any silicone oil, for example, SH® 200. Many crosslinked silicone compounds are commercially available and are useful for incorporation into the films of the present invention. These include, for example, the preferred crosslinked siloxane compound Tospearl® manufactured by Toshiba Silicone, Tokyo, Japan.

One or both of the exposed surfaces of the film of the present invention may be treated to provide the film of the present invention with further useful properties and functionalities. These include for example corona treatment and treatments that enhance receptivity for printing, especially for good compatibility with water based inks.

Optimum film characteristics for machining include a low coefficient of friction, COF (good slip properties) and low block, i.e. the film surfaces should not stick together and should not interfere with rolling and packing. These characteristics are imparted by the slip agents and the antiblock agents, respectively, of the films of the present invention.

In particular, the present invention provides a heat-sealable multilayer white opaque plastic film in which the core layer is cavitated and is formed from polypropylene. The film has a top tie layer of polypropylene and a whitening

agent. This top tie is positioned adjacent to the first surface of the core layer. A top skin layer of polypropylene or a polyolefin terpolymer is positioned adjacent to the top tie layer. The top skin layer also contains $SiO_2$ and an antiblock agent. A bottom tie layer formed from polypropylene is postioned adjacent to the second surface of the core layer. A bottom skin layer formed from a polyolefin terpolymer is positioned adjacent to the bottom tie layer and contains $SiO_2$. The bottom skin layer may further contain one or more other antiblock agents or antiblock slip agents.

The core layer preferably includes from about 7% to about 9% cavitating agent, which may be any hard small particle compound, preferably PBT optimally present at 8%; from about 500ppm to about 700ppm of an antioxidant, preferably a phosphite, optimally present at 600ppm; and from about 200ppm to about 400ppm of an anti-condensing agent, preferably a fluoropolymer and optimally the fluoropolymer is present at 300ppm.

The top tie layer preferably include up to 10% $TiO_2$, preferably up to 8%, more preferably up to 6%, and optimally about 4% $TiO_2$.

The top skin layer preferably includes from about 0.1% to about 0.5% $SiO_2$, preferably from about 0.15% to about 0.4% $SiO_2$, more preferably from about 0.2% to about 0.3% $SiO_2$, and optimally about 0.23% $SiO_2$; and from about 0.1% to 0.5% of the antiblock agent, preferably from about 0.2% to about 0.4%, more preferably from about 0.15% to about 0.3% of the antiblock agent, and optimally about 0.2% of the antiblock agent.

The bottom skin layer preferably includes: EPB terpolymer and from about 0.6% to 2.4% of an antiblock agent which may be any antiblock agent, for example a silicone oil, preferably the antiblock agent comprises from about 0.9% to 1.8% of the bottom skin layer (optimally 1.2%); from about .05% to about .15% $SiO_2$ (optimally 0.1% $SiO_2$) from about 0.15% to about 0.3% of an antiblock slip agent, which may be any antiblock slip agent, such as for example a crosslinked silicone (optimally comprising 0.23% of the layer).

In a yet further embodiment of the first aspect of the invention the total film thickness of the heat-sealable multilayer white opaque plastic film is about 1mil and the top skin layer constitutes about 2.5% of the total film thickness; the

top tie layer forms about 15% of the total film thickness, the core layer accounts for about 63% of the total film thickness, the bottom tie layer forms about 15% of the total film thickness, and the bottom skin layer constitutes about 4% of the total film thickness.

In a particularly favored embodiment, the five layer white opaque plastic film of the present invention is heat sealable on one side and has the following composition: the top skin layer is corona treated and is formed from polypropylene and 0.23% Sylobloc® 45 (W.R. Grace, New York, NY) and 0.2% Epostar® MA1002; the top tie layer is formed from polypropylene and 4% Millenium RCL4®; the core layer is formed from polypropylene and includes 8% BPT, 600ppm Ultranox® 626 (Borg-Warner Chemicals Inc., Parkersburg, VA), and 300ppm of the fluoroplastic, Dyneon ® flurololymer FX9613 (3M, St. Paul, MN); the bottom tie layer is also formed from polypropylene, and the bottom skin layer is formed from the EPB terpolymer, Chisso® 7753 and includes 1.2% SH200, 0.1%Sylobloc® 44 (W.R. Grace, New York, NY) and 0.23% Tospearl® 130 (Toshiba Silicone, Tokyo, Japan).

In another particularly favored embodiment, the five layer white opaque plastic film of the present invention is heat-sealable on two sides and has the following composition: the top skin layer is corona-treated and is formed from an EPB terpolymer, Chisso 7300 and includes 0.23% $SiO_2$ as Sylobloc® 45, 0.2% antiblock agent as Epostar® MA1002 (Cross-linked polymethacrlyate, with a 2-3um average particle size; a refractive index of 1.49, and a specific gravity of 1.2), the top tie layer includes 4% $TiO_2$ as Millenium RCL4®; the core layer includes polypropylene and 8% of a cavitating agent, which is PBT; 600ppm of an antioxidant phosphite which is Ultranox® 626 and 300ppm of an anti-condensing agent which is the Dyneon® flurololymer FX9613; the bottom skin layer is formed from the EPB terpolymer, Chisso® 7753 (Chisso Corp., Osaka, Japan); and includes the antiblock agents, silicone oil, SH 200® at 1.2%, uncoated silica, Sylobloc® 44 (W.R. Grace, New York, NY) at 0.1% and 0.23% of the crosslinked silicone, Tospearl® 130 (Toshiba Silicone, Tokyo, Japan).

**EXAMPLES**

Example 1 (Comparative Example)

A three layer, one side heat sealable plastic film of the following composition was manufactured and provided for comparative purposes:

----------This Surface Treated----------

| | | |
|---|---|---|
| Layer 1 | Exxon® 4612 PP<br>+ 4% Millenium RCL4® $TiO_2$ | 25 ga |
| Core | PP homopolymer of high stereo-regularity, e.g. Exxon® 4612 +<br>8% PBT cavitating agent: Ticona Celanese® 1300A or equivalent | 65 ga |
| Layer 2 | EPB terpolymer + 0.23% Sylobloc® 44<br>+ 1.25% silicone fluid: 30,000 centistokes | 8 ga |

The layers were combined in the melt, quenched, reheated, and stretched to 5.3X in the machine direction. Subsequently, the sheet was reheated and stretched about 8-10X in a tenter frame. Skin 1 was corona treated to about 40 dynes and wound in a mill roll form.

Example 2

The following one side heat-sealable, five layer film structure was produced according to the process of Example 1.

----------This Surface Treated----------

| | | |
|---|---|---|
| Layer A | PP + 0.23% Sylobloc® 45<br>+ 0.2% Epostar® MA 1002 | 2-3 ga |
| Layer B | PP (Exxon® 4612) +<br>$TiO_2$ (4% Millenium RCL4®) | 15 ga |
| Layer C | PP homopolymer of high stereo-regularity, such as Exxon® 4612 +<br>8% PBT cavitating agent (Ticona Celanese® 1300A or equivalent) | 61 ga |
| Layer D | PP<br>(isotactic homopolymer) | 15 ga |
| Layer E | EPB terpolymer (with DSC melting point of 122.5°C)<br>+ 0.10% Sylobloc® 44 + 0.1% Tospearl® T130<br>+ 1.25% silicone fluid (30,000 centistokes) | 4 ga |

Example 3

The following two side heat-sealable, five layer film structure was produced accoring to the process of Example 1.

----------This Surface Treated----------

| | | |
|---|---|---|
| Layer A | EPB terpolymer (with DSC melting point of 137°C) + 0.23% Sylobloc® 45 + 0.2% Epostar® MA 1002 | 2-3 ga |
| Layer B | PP (Exxon® 4612) + $TiO_2$ (4% Millenium RCL4®) | 15 ga |
| Layer C | PP homopolymer of high stereo-regularity, such as Exxon® 4612. 8% PBT cavitating agent (Ticona Celanese® 1300A or equivalent) | 61 ga |
| Layer D | PP (isotactic homopolymer) | 15 ga |
| Layer E | EPB terpolymer + 0.10% Sylobloc® 44 + 0.1% Tospearl® T130 + 1.25% silicone fluid (30,000 centistokes) | 4 ga |

The films of Examples 2 and 3 have the following advantages over the film of comparative Example 1:

(a) The layer containing $TiO_2$ may be reduced from 25 ga in Layer 1 of Example 1 to 15 ga in Layer B of Examples 2 and 3, representing a 40% reduction in materials cost for this layer.

(b) The sealable layer may be reduced from 8 ga in Layer 3 of Example 1 to 4 ga of Layer E of Examples 2 and 3, representing a 50% lower material cost.

The film of Example 3 is heat sealable on two sides, with a somewhat peelable seal, and is suitable for ice cream sandwich applications.

To simulate film performance in manufacturing, the following tests were run:

1. COF (Coefficient of fricion).
2. Hot slip (Film on metal at high temperatures).
3. $TiO_2$ plate out testing ink adhesion monitoring on a Chestnut press (Flexo printing machine).
4. Fuji HFFS (Horizontal form, fill and seal): Testing for machinability.

5. Hayssen VFFS (Vertical form, fill and seal): Laminating a standard film (50LBW) to the test film sample(s) and testing hot tack with 16oz kidney beans as the test load.

Table 1 lists the performance and properties of these films.

**TABLE 1: Film Properties and Performance**

| Example | COF | | Treated side hot slip | | $TiO_2$ | Ink Adhesion | | Fuji HFFS | | Hayssen VFFS | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | T/T | U/U | 250°F | 275°F | Plate-out | Solvent | Water | Machinability | Seal @290°F (gm/in) | Hot tack | Seal @270°F (gm/in) |
| 1 | 0.34 | 0.41 | 0.59 | 0.6 | Failed | Passed | OK | Passed | 405 | Creep 280-310°F | 645 |
| 2 | 0.26 | 0.23 | 0.63 | 0.69 | Passed | Passed | OK | Passed | 695 | No Creep | 945 |
| 3 | 0.25 | 0.23 | 0.92 | 1.48 | Passed | Passed | Passed | Passed | 695 | No Creep | 945 |
| | For $TiO_2$ | | | | | | | | | | |
| | Failed = Can wipe $TiO_2$ off film surface | | | | | Passed = > 95% ink adhesion | | | | | |
| | Passed = Cannot wipe $TiO_2$ off film surface | | | | | OK = 50 to 95% ink adhesion | | | | | |

As can be seen from Table 1, the films of Examples 2 and 3 provide a significantly lower and more consistent COF then the film of Example 1. The films of Example 1 and Example 2 provide good hot slip properties and eliminate plate out of the $TiO_2$. The films of Example 2 provide good ink adhesion properties, while the films of Example 3 provide improved ink adhesion properties. The films of Example 2 and 3 provide good machineability. Finally, the films of Example 2 and 3 provide improved hot tack, and have improved z-tear performance (without creep), which is important for VFFS (Vertical form, fill and seal) applications.

**WHAT IS CLAIMED IS:**

1. A heat-sealable multilayer white opaque plastic film, comprising:
   i) a cavitated core layer comprising polypropylene and having a first and a second surface;
   ii) a top tie layer comprising polypropylene and a whitening agent, said top tie layer positioned adjacent to said first surface of the core layer;
   iii) a top skin layer comprising polypropylene or a polyolefin terpolymer, an antiblock agent, said top skin layer positioned adjacent to said top tie layer;
   iv) a bottom tie layer comprising polypropylene, said bottom tie layer positioned adjacent to said second surface of the core layer; and
   v) a bottom skin layer comprising a polyolefin terpolymer, and one or more antiblock agents or antiblock slip agents, said bottom skin positioned adjacent to said bottom tie layer.

2. The film according to claim 1, wherein:
   i) the top skin layer comprises polypropylene and $SiO_2$,
   ii) the cavitating agent of the core layer comprises polybutylene terephthalate,
   iii) the polyolefin terpolymer of the bottom skin layer comprises an ethylene- propylene- butylene terpolymer; and
   iv) the bottom skin layer further comprises $SiO_2$, a silicone oil, and a crosslinked silicone.

3. The film according to claim 2, wherein:
   i) the top skin layer comprises from about 0.1% to about 0.5% $SiO_2$, and from about 0.1% to about 0.5% of a second antiblock agent; and
   ii) the top tie layer comprises up to 10% $TiO_2$.

4. The film according to claim 3, wherein:

   i) the top polypropylene skin layer comprises from about 0.15% to about 0.3% $SiO_2$ in the form of coated silica and from about 0.15% to about 0.25% methyl acrylate antiblock agent,

   ii) the core layer comprises from about 7% to about 9% polybutylene terephthalate, from about 500ppm to about 700ppm phosphite antioxidant, and from about 200ppm to about 400ppm fluoropolymer anti-condensing agent,

   iii) the bottom skin layer comprises an ethylene-propylene-butylene terpolymer and further comprises from about 0.6% to about 2.4% silicone oil antiblock, and from about 0.15% to about 0.3% crosslinked silicone antiblock slip agent.

5. The film according to claim 4, wherein the total film thickness is about 1mil and

   i) the top skin layer comprises about 2.5% of the total film thickness,

   ii) the top tie layer comprises about 15% of the total film thickness,

   iii) the core layer comprises about 63% of the total film thickness,

   iv) the bottom tie layer comprises about 15% of the total film thickness, and

   v) the bottom skin layer comprises about 4% of the total film thickness.

6. The film according to claim 1, wherein:

   i) the top skin layer comprises an ethylene-propylene-butylene terpolymer,

   ii) the cavitating agent of the core layer comprises polybutylene terephthalate, the antioxidant comprises a phosphite, and the anti-condensing agent comprises a fluoropolymer,

   iii) the polyolefin terpolymer of the bottom skin layer comprises an ethylene-propylene-butylene terpolymer, and

v) the bottom skin layer further comprises an antiblock agent and an antiblock slip agent, wherein the antiblock agent comprises silicone oil, and the antiblock slip agent comprises a crosslinked silicone.

7. The film according to claim 6, wherein:

i) the top skin layer comprises ethylene-propylene-butylene-terpolymer and further comprises from about 0.15% to about 0.3% $SiO_2$ in the form of coated silica, and from about 0.15% to about 0.25% methyl acrylate antiblock agent,

ii) the core layer comprises from about 7% to about 9% polybutylene terephthalate, from about 500ppm to about 700ppm phosphite antioxidant, and from about 200ppm to about 400ppm fluoropolymer anti-condensing agent; and

iii) the bottom skin layer comprises ethylene-propylene-butylene terpolymer and further comprises from about 0.6% to about 2.4% silicone oil antiblock, and from about 0.15% to about 0.3% crosslinked silicone antiblock slip agent.

8. The film according to claim 7, wherein the total film thickness is about 1mil and

i) the top skin layer comprises about 2.5% of the total film thickness,

ii) the top tie layer comprises about 15% of the total film thickness,

iii) the core layer comprises about 63% of the total film thickness,

iv) the bottom tie layer comprises about 15% of the total film thickness, and

v) the bottom skin layer comprises about 4% of the total film thickness.

9. A method of packaging a frozen novelty, comprising:

i) providing a frozen ice cream preparation,

ii) enclosing the ice cream preparation in a heat-sealable white opaque multilayer plastic film, and

iii) sealing the film to enclose the frozen ice cream preparation.

10. The method of claim 9 wherein the heat-sealable white opaque multilayer plastic film comprises:

i) a cavitated core layer comprising polypropylene and having a first and a second surface;

ii) a top tie layer comprising polypropylene and a whitening agent, said top tie layer positioned adjacent to said first surface of the core layer;

iii) a top skin layer comprising polypropylene or a polyolefin terpolymer, an antiblock agent, said top skin layer positioned adjacent to said top tie layer;

iv) a bottom tie layer comprising polypropylene, said bottom tie layer positioned adjacent to said second surface of the core layer; and

v) a bottom skin layer comprising a polyolefin terpolymer, and one or more antiblock agents or antiblock slip agents, said bottom skin positioned adjacent to said bottom tie layer.

## ABSTRACT

A multilayer white opaque plastic film, heat-sealable on one or two sides, suitable for packaging uses. The multilayer film includes a cavitated core layer of polypropylene, a top intermediate tie layer of polypropylene with interspersed titanium dioxide, a bottom intermediate tie layer of polypropylene, a top and a bottom skin layer. The top skin layer is formed from a polylefin terpolymer or polypropylene. The top skin layer may include silicon dioxide and an antiblock agent, and optionally may be corona treated. The bottom skin layer is formed from a polylefin terpolymer, and may also include silicon dioxide and one or more antiblock or slip agents.

Case Docket No. 10188

"PATENT"

**DECLARATION FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**Heat-Sealable Multilayer White Opaque Film**

the specification of which is attached hereto unless the following box is checked:

[ ] was filed on _____ as Application Serial No. _____

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate(s), or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application(s) for patent or inventor's certificate(s), or PCT International application having a filing date before that of the application on which priority is claimed.

| Prior Foreign Application(s) | | | Priority Claimed | |
|---|---|---|---|---|
| (Number) | (Country) | (Day/Month/Year Filed) | [ ] Yes | [ ] No |

I hereby claim the benefit under 35 U.S.C. § 119(e)(1)-(2) of any United States provisional application(s) listed below.

| 06/159,205 | October 13, 1999 |
|---|---|
| (Application Number) | (Filing Date) |

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose material information which is material to patentability as defined in 37 CFR § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

| (Application Serial No.) | (Filing Date) | (Status - patented, pending, abandoned) |
|---|---|---|

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

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| Bradley A. Keller | 37,654 |
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| Dennis Santini | 26,029 |
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Inventor's signature Robert A. Migliorini Date 9/18/00

Case Docket No. 10188

"PATENT"

**DECLARATION FOR PATENT APPLICATION**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**Heat-Sealable Multilayer White Opaque Film**

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